

No Analytical crib available  
March 1, 2008  
Written by Professor Cheng

---

No Biochemistry crib available  
March 1, 2008  
Written by Professor Van Etten

---

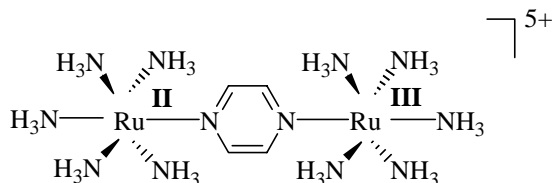
---

No Physical crib available  
March 1, 2008  
Written by Professor Raftery

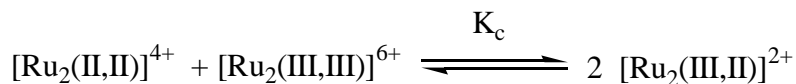
## Inorganic Cumulative Exam (March 1, 2008)

1 (30) A recent inorganic literature seminar was titled “Unconventional mixed valency”. The following questions are about *conventional mixed valency* (stuff you may find in *Miessler and Tarr*).

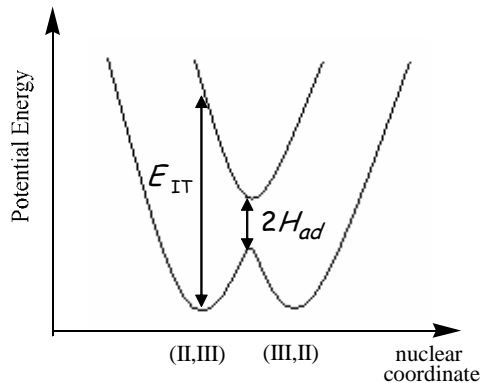
A Sketch the structure of the Creutz-Taube ion (be as precise as you can).



B Write the so-called *comproportionation* equilibrium equation for the Creutz-Taube ion



C Provide a graphic sketch to explain the term “IVCT”.



D The formal oxidation potentials related to a mixed valent monocation are:  $E^\circ(+2/+1+) = -0.40 \text{ V}$  and  $E^\circ(+2/+1+) = -0.76 \text{ V}$  at  $25^\circ\text{C}$ . What is the *comproportionation* constant for this mixed valent species? ( $2.3026 \text{ RT/F} = 59.16 \text{ mV}$  at  $25^\circ\text{C}$ )

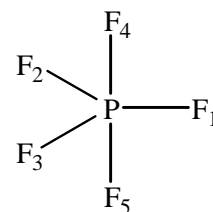
$$K_c = \exp(-\Delta G^\circ/\text{RT}) = \exp [F(\Delta E)/\text{RT}] = 10^{6.1}$$

2 (30) Assign symmetry point groups for the following molecules/objects (**mark symmetry elements clearly**).

(a) $C_{2h}$ 	(b) $C_s$ 	(c) $C_{4v}$ 	(d) $C_{2h}$ 
(f) $D_{3h}$ 	(g) $D_{2h}$ 	(h) $C_{2v}$ 	(i) (6 pt) $T_d$ 

3. (20) What are the SALCs made up of  $\sigma$ -orbitals on F atoms that can be employed in forming P-F bonds in  $\text{PF}_5$ ?

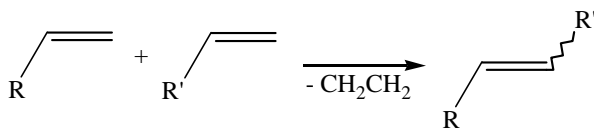
$D_{3h}$	E	$2C_3$	$3C_2$	$\sigma_h$	$2S_3$	$3\sigma_v$	
$A'_1$	1	1	1	1	1	1	
$A'_2$	1	1	-1	1	1	-1	
$E'$	2	-1	0	2	-1	0	
$A''_1$	1	1	1	-1	-1	-1	
$A''_2$	1	1	-1	-1	-1	1	
$E''$	2	-1	0	-2	1	0	
$\Gamma(1-3)$	3	0	1	3	0	1	= $A'_1 + E'$
$\Gamma(4,5)$	2	2	0	0	0	2	= $A'_1 + A''_2$



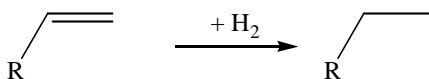
$$\begin{aligned}
 \text{F1 - F3} \quad \phi_{A'_1} &= (\sigma_1 + \sigma_2 + \sigma_3)/\sqrt{3} \\
 \phi_{E'_x} &= (2\sigma_1 - \sigma_2 - \sigma_3)/\sqrt{6} \\
 \phi_{E'_y} &= (\sigma_2 - \sigma_3)/\sqrt{2} \\
 \text{F4 - F5} \quad \phi_{A'_1} &= (\sigma_4 + \sigma_5)/\sqrt{2} \\
 \phi_{A''_2} &= (\sigma_4 - \sigma_5)/\sqrt{2}
 \end{aligned}$$

4 (20) Provide a representative reaction equation for reactions catalyzed by each of the following catalysts

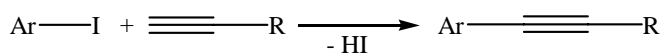
a) Grubbs 2<sup>nd</sup> generation catalyst



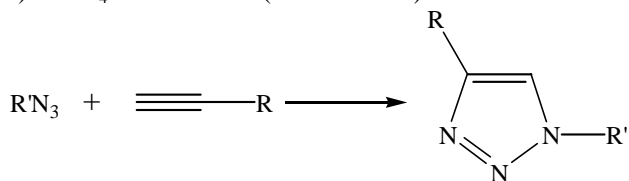
b) Wilkinson's catalyst



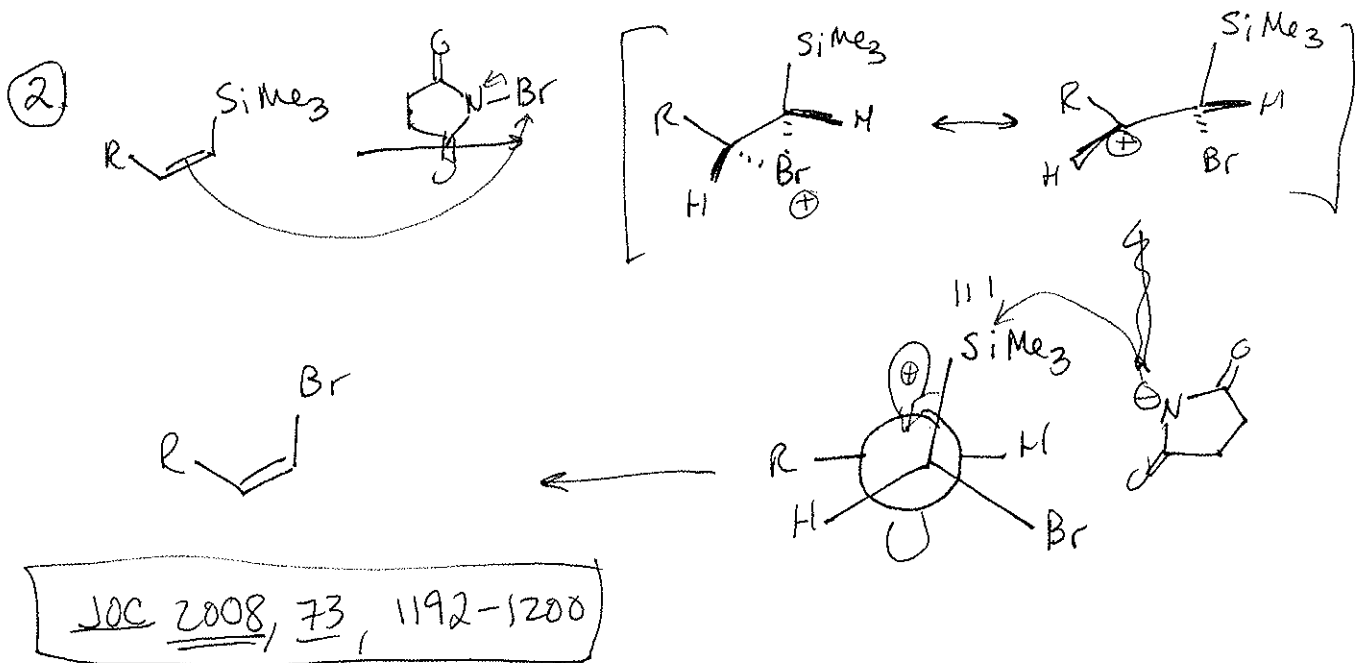
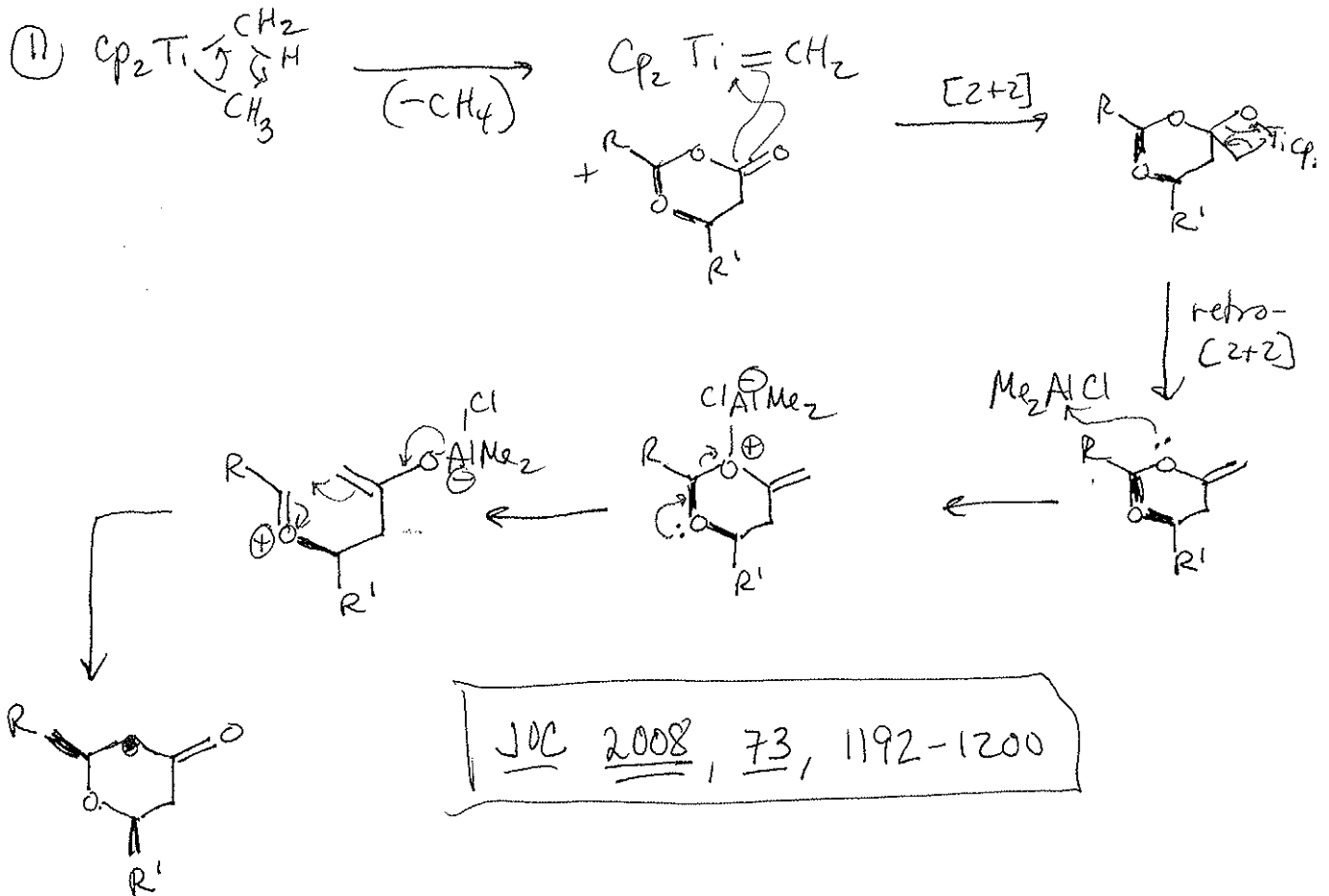
c)  $\text{Pd}(\text{PPh}_3)_2\text{Cl}_2/\text{CuI}/\text{base}$  (Sonogashira)

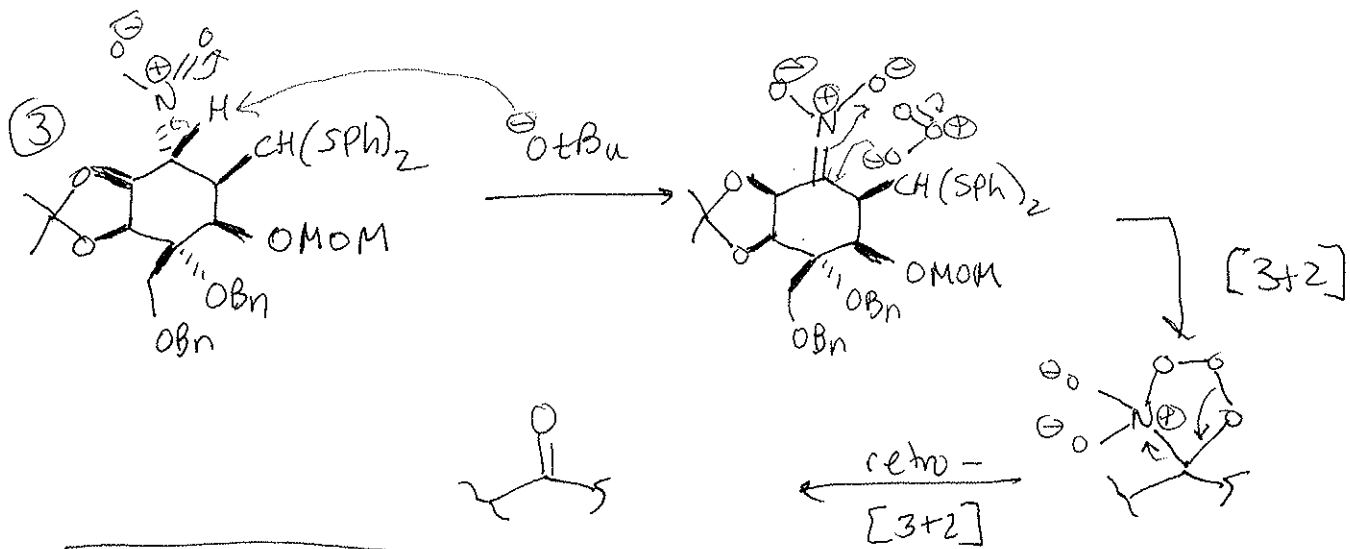


d)  $\text{CuSO}_4/\text{ascorbic acid}$  (click reaction)

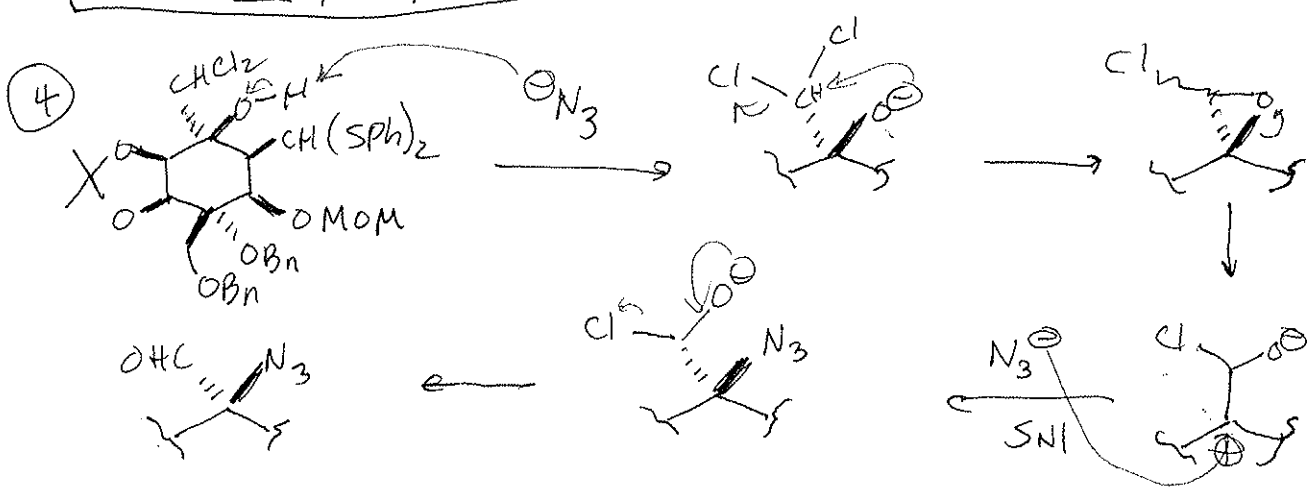


# March Organic Cume Crib

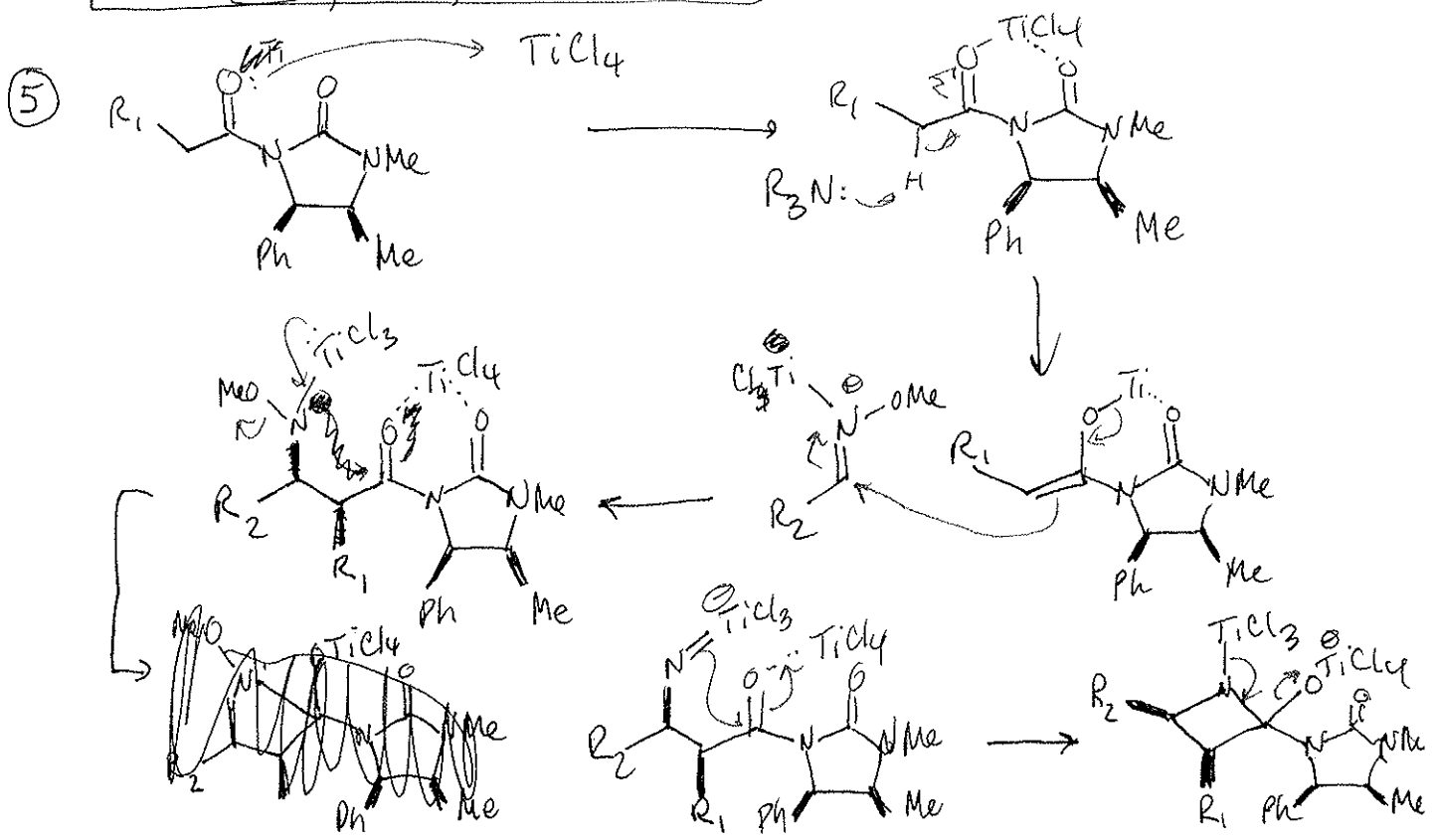




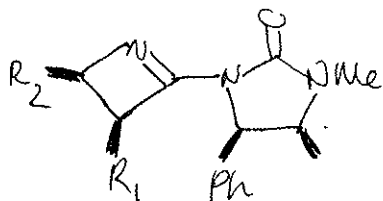
JOC 2008, 73, 1234-1242



JOC 2008, 73, 1234-1242

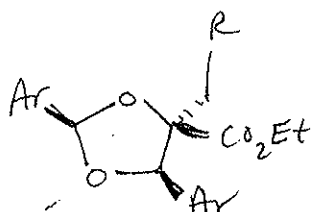
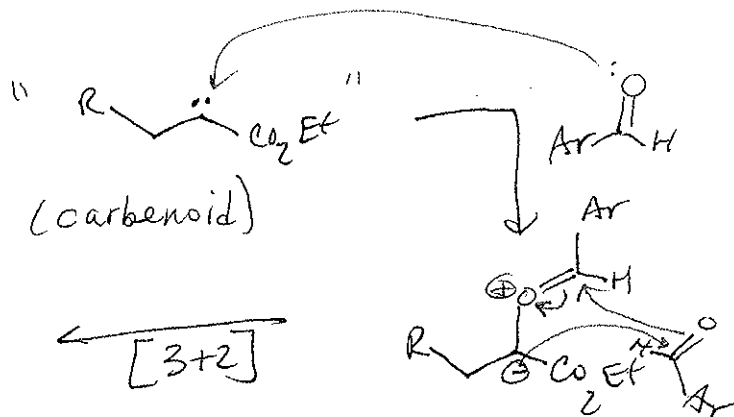
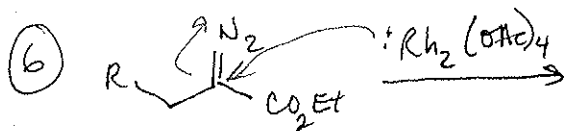


⑤ (cont'd)



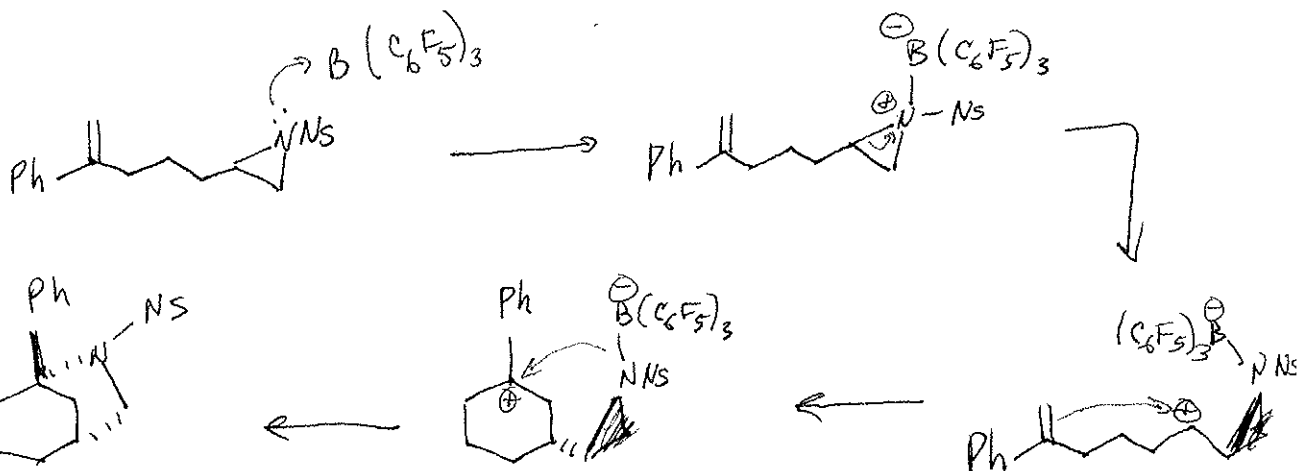
NOTE: This is the correct product; the product shown in the cume is erroneous.

JOC 2008, 73, 1264-1269



JOC 2008, 73, 1435-1439

⑦



JOC 2008, 73, 1462-1467